



## THE COMMONWEALTH OF MASSACHUSETTS

WATER RESOURCES COMMISSION  
100 CAMBRIDGE STREET, BOSTON MA 02114

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### **Meeting Minutes for January 13, 2005**

#### **Members in Attendance:**

Karl Honkonen	Designee, EOE
Marilyn Contreas	Designee, DHCD
Cynthia Giles	Designee, DEP
Gerard Kennedy	Designee, DAR
Mark Tisa	Designee, DFG
Mike Gildesgame	Designee, DCR
Joseph Pelczarski	Designee, CZM
David Rich	Public Member
Gary Clayton	Public Member
Bob Zimmerman	Public Member

#### **Others in Attendance:**

Linda Marler	DCR
Sara Cohen	DCR
Ron Sharpin	DCR
Steve Garabedian	USGS
Ted McIntire	Town of Reading
Peter Tassi	Town of Reading
Dan Howland	Town of Reading
John Gall	CDM
David Brew	MWRA
Margaret Kearns	Riverways
Kerry Mackin	IRWA
Gregg Rishell	National Weather Service
Meredith Norton	MWRA
Lise Marx	MWRA
Robert Kovacs	MWRA
Jonathan Yeo	MWRA
Paul Hogan	DEP
Emile Hamway	Fay, Spofford & Thorndike
Tom LaRosa	DCR
Frank Hartig	DCR
Michael Smith	Sen. Shannon's Office
John Reinhardt	DEP
Mingyuan Pan	DEP

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**Agenda Item #1: Executive Director's Report**

Honkonen provided the Executive Director's report:

- The Reading issue has been taking up a good deal of Staff's time. The WRC approved the Interbasin Transfer application in December. Since that time, the Secretary and he have received a variety of correspondence from the Ipswich River Watershed Association. Honkonen distributed copies of this correspondence. The Ipswich River Watershed Association sent a letter asking that the Commission reconsider and rehear the final decision of December 9<sup>th</sup>, 2004 to approve the Interbasin Transfer application for the town of Reading. Honkonen said he did not want to get into the substance of the decision at this meeting because all parties involved have not received adequate notice in order to review all these documents. Honkonen recommended that a discussion of whether or not to grant the request for reconsideration be placed on the February agenda. This will give Commission members and other interested parties time to review the request and discuss whether or not to grant the request. It will also give interested parties sufficient notice of the vote. Honkonen's understanding from talking to EOE and DCR legal and WRC staffs is that there are no apparent precedents for the WRC to entertain a request for reconsideration of its decisions. There is no mechanism in the Interbasin Transfer Act or its regulations for reconsideration of a decision. The Attorney General's Office has advised us informally the WRC may, as a matter of its discretion, entertain this request if it chooses. Generally the purpose of reconsidering a vote is to permit correction of an erroneous action or to take into account new information or a changed circumstance that has developed since the taking of the vote on December 9<sup>th</sup>. Clayton said he supported this because there has been a lot of interest in this and because of the amount of information that has been provided to date. To take any action today would be ill-advised.

Marler provided an update on the hydrologic conditions:

- Water conditions in Massachusetts are good.
- Precipitation in December was normal to above normal across the state. The regions received between 101% and 134% of normal precipitation. January precipitation to date is above normal for the month and it is expected that the month will end with normal to above normal precipitation. There has been a decent amount of snow, so far. Gregg Rishell from the National Weather Service is here today and will be discussing this further.
- Ground water levels are normal to above normal.
- Reservoir levels in the normal to above normal range.
- Fire danger is low.
- Drought predictions indicate that Massachusetts is not in a drought. There has been a wet cycle for the past twelve months.
- The long-range forecast for February, March and April indicate equal chances for temperature being below normal, normal or above normal, but is predicting below normal precipitation. This is something to watch.

Honkonen continued with the Executive Director's Report:

- The water policy task force has developed 10 recommendations. The task force has asked a number of agencies, including DCR's WRC Staff, to assist in implementing the recommendations. This will take up a fair amount of the WRC's work plan for 2005. Knowing that there is a full agenda today, Honkonen recommended that the WRC look at the

implementation of these recommendations at next month's meeting. Clayton followed up with a suggestion that the WRC to look at implementation of the work plan on a quarterly basis. It is useful to have the WRC continuously review items that are on the work plan and determine if anything needs to change.

- The 1992 Water Conservation Standards will be updated as part of the task force's recommendation. Anne Monnelly, DCR, is pulling together a work group to develop the revised water conservation standards. The work group will consist of agency personnel, as well as members from the water utilities and non-profit groups.
- Another recommendation of the task force was to develop a water supply protection program where EOEA will fund the acquisition of land by municipalities for water supply protection. These funds are about to be released.
- Honkonen referred to the IBT status report in the package. These are either ongoing projects or projects in the initial stages that will require a fair amount of analysis by WRC staff. He advised Commission members to stay aware of these items.
- Clayton and Zimmerman have been officially reappointed as public members. Rich is in the process of being reappointed. The Secretary has received two nominations from the Ground Water Association to fill the required seat on the Commission. Honkonen will be scheduling reviews and interviews for these people and is hoping to have this completed soon.

Tisa followed up on his suggestion of last month to send out a letter of thanks to former Commission members. He suggested an official letter from the Commission thanking those long-serving members for their years of service. Honkonen said he would see to it that this gets done and will copy current Commission members into this correspondence.

#### **Agenda Item #2: Vote – Meeting Minutes for October 2003, July 2004, August 2004, and September 2004**

- A motion was made by Giles to approve the minutes for October 2003 and was seconded Contreas. The vote was five in favor with four abstentions.
- A motion was made by Giles to approve the minutes for July 2004 and was seconded by Tisa. The vote was seven in favor with two abstentions.
- A motion was made by Giles to approve the minutes for August 2004 and was seconded by Tisa. The vote was six in favor with three abstentions.
- A motion was made by Contreas to approve the minutes for September 2004 and was seconded by Tisa. The vote was six in favor with three abstentions.

Gildesgame stated that by next month, the most current minutes would be posted on the WRC website.

#### **Agenda Item #3: Presentation – Staff Recommendation on the Interbasin Transfer Application for the Cummingsville Branch Replacement Sewer**

Marler reminded Commissioners that the draft Staff Recommendation had been sent out with the Commission package. This is a proposal from the MWRA to increase the capacity of the Cummingsville Branch Sewer. The representatives of the MWRA and their consultants were acknowledged. The Cummingsville Sewer serves Burlington, most of Woburn and a small

portion of Winchester. Wastewater is generated from the Mystic River subbasin of the Boston Harbor basin, the Shawsheen River basin and the Ipswich River basin and discharged to the Massachusetts Coastal basin via the MWRA Deer Island treatment plant. Overflows occur during wet weather, peak storms at both Horn Pond in Woburn and Vine Brook and Burlington. Enlarging the MWRA portion of the sewer will alleviate some of these overflows that occur at a bottleneck in the Cummingsville section of Winchester.

The areas served by the Cummingsville sewer are highly developed and mostly sewered. In the 1980's, infiltration and inflow (I/I) problems became apparent and DEP issued administrative consent orders (ACO) to Burlington and Woburn. The design storm event is causing peak wastewater flows of 21.6 mgd. This exceeds the existing system capacity of 20.3 mgd. The towns have been documenting these overflows in response to the ACOs. There have been five overflow occurrences since 1996 in Burlington and three in Woburn. Zimmerman asked if this was "per year" or "total". Marler replied that it was total. It doesn't happen often. The MWRA's analysis has determined that I/I removal alone will not satisfy current capacity needs. I/I removal will result in an improvement in the system, but will not take care of the overflow events.

The MWRA is proposing that an older section of the sewer (circa 1894) be abandoned; the Cummingsville Branch Relief sewer (circa 1952) will be cleaned and sealed and will continue to be used; and the Cummingsville Branch Replacement sewer will be constructed to add capacity to the system. The new system capacity will be 24.7 mgd. Average day flow is 10-11 mgd. This added capacity is to address storm events. The reason this is an interbasin transfer is that the overflows, which end up in the Mystic River subbasin and the Shawsheen basin, will be transported to the Massachusetts Coastal basin. The increased capacity of the new system is 4.4 mgd. It will not be used everyday; it will only be needed during peak storm events. In addition, overflows will still occur at storms of greater magnitude than the design storm (the 1 year 6 hour storm). The problem will not be entirely alleviated.

The project was reviewed with respect to the Interbasin Transfer criteria. Not all of the criteria apply to wastewater transfers. MEPA compliance has been achieved. There was a notice of project change in 1999 that received a final Secretary's Certificate. Evaluation of the viable in-basin sources criterion for sewer systems requires that the proponent look at alternative wastewater disposal options. There were some studies completed in 1975 and 1984 that concluded that in-basin wastewater treatment was not feasible in these areas due to siting problems and public water supply and health issues. The MWRA developed a facilities plan for the Cummingsville Branch sewer in 1995 and DEP felt that this addresses relevant issues and that it is being implemented. The proponent was also directed to look at wastewater reuse. It is not feasible to reuse wastewater in these areas because the wastewater would need to be piped to Deer Island and back. To address the water conservation criterion for a wastewater transfer, I/I removal programs are reviewed. MWRA has a 2002 regional I/I reduction plan. MWRA does not have jurisdiction over the towns' programs, but they did provide information on the I/I removal programs being implemented by tributary towns. Burlington, Woburn and Winchester have fairly aggressive I/I removal programs. The reasonable instream flow analysis focused on high flow events because the only loss of flow from the donor basins occurs during storm (high flow) events. It was a difficult analysis. The Horn Pond sewer overflow occurs through a manhole. There are tables in the Staff Recommendation that quantify these analyses. It is

difficult to measure accurately. At the public hearing, some residents of Woburn displayed photographs this overflow, which is located in their front yard. The flow exits the manhole and flows overland to Horn Pond. Woburn's water supplies are also located in this area. It is not a good situation. When the overflows occur at Horn Pond, Woburn is required to notify Burlington immediately. At these times, Burlington directs overflows, with chlorination, to Vine Brook.

In order to quantify impacts from this transfer in Burlington, the USGS gage on the Shawsheen River was used. In Woburn, the gage downstream on the Aberjona River was examined. Overflows in Burlington were analyzed. There were five documented overflow events. During these events, the Shawsheen River is flowing at 4.9 to 25 cubic feet per second per square mile (cfs) of drainage area. These are really high flows. The reduction at Vine Brook, if all of these overflows are removed, would be up to 8% during the high flow events. This would reduce the high flows by 0.2 cfs. If this amount is compared to the existing flows, this does not represent a significant impact. The Shawsheen River experiences flooding in the downstream reaches under these kinds of conditions, so this might be a benefit. In addition, there are public water supplies in the vicinity of Vine Brook, so elimination of the overflow will be a positive action.

The Woburn Horn Pond overflows were also analyzed. The overflows occur at a topographic low point in the sewer system, near a Woburn residents' yard and flow overland into Horn Pond. This presents a public health concern. The overflows are estimated from three events that have been documented since 2001. Again, because they are flowing out of the manhole, it is difficult to accurately estimate the overflow volume. But using these estimates, elimination of the overflows to Horn Pond and then into Horn Pond Brook, represent 5% (maximum). At the time these overflows are occurring, the Aberjona River is flowing at 8-24 cfs and flooding is occurring in Winchester. The loss of this overflow will not be significant. It will reduce high flows in the Aberjona River by 0.5 cfs. In addition, Woburn has public water supply wells at Horn Pond. Horn Pond is also used for recreation.

The Local Water Resources Management Plan criterion has been addressed previously. In 1999, the WRC approved MWRA's Local Water Resources Management Plan, submitted as required by the Braintree-Weymouth ITA approval.

It is not expected that this project will result in cumulative impacts. This project will not result in increased sewerage in the tributary communities because these communities are already highly developed and almost fully sewerage. The Aberjona River at Winchester is highly stressed, but this transfer will not have an impact on low flows. There are obvious benefits to water quality, public health and public safety.

Public hearings were held on December 16<sup>th</sup> in Boston and Woburn. The Boston hearing was not well attended. A number of local public officials attended the Woburn hearing, generously hosted by the town of Woburn, which shared their holiday party leftovers. Contreas and Honkonen attended the Woburn hearing. Everyone attending the Woburn hearing was supportive of the project. Some residents attended and shared photos of the overflows at Horn Pond. Staff hoped to have pictures of these overflows for this meeting, but was unable to obtain any. There will be another public hearing on the draft Staff Recommendation on January 20<sup>th</sup> at 2 pm in this building. Commission members are encouraged to attend.

Zimmerman asked if the proponents had looked at stormwater management and recharge. Kovacs said that the project was designed to keep as much non-sanitary sewerage out of the sewer system as possible, but by their nature, sewer pipes were not water tight. Zimmerman said that what causes the overflows are inflows, not infiltration. Kovacs said it is a combination of both. Zimmerman asked if an effort had been made to capture rainfall before it gets into the pipes and get it back into the ground where it belongs. Kovacs answered that inflow involves pipes, illegal or otherwise, as well as sump pumps and other things like that, physical direct connections that allow rainwater to enter the sewer system. The exclusion of that is part of the I/I program. DEP has consent orders with the communities to correct this. All possible efforts are being made to find these connections and remove them. Zimmerman said that this answers his question.

Clayton said the problem of raw sewage flowing into people's yards and Horn Pond is unacceptable. He had some questions about the cumulative impacts. He referred to the statement in the Staff Recommendation that the purpose of the project was not to expand the sewer service area but to improve system capacity. He understands that the communities are densely developed, but land use patterns change resulting in high rises, etc. What assures us that this added capacity will not be used for more intensive development, so that 10 years from now we are facing the same problem? Giles said that there is a 10:1 ratio requirement for I/I removal for any additional wastewater that would be added to the system, so that there will be no net increases in wastewater flow. In fact, there will be net decreases where that is feasible.

Clayton also asked about conservation measures. He noted that I/I removal is laudable. And he noted that MWRA is not responsible for the communities, so the responsibility is ultimately up to the community. How do we assure ourselves that in fact the community will take these actions? Giles answered that most of these communities are under an ACO from DEP. Winchester is not, but it does not contribute as much wastewater to this system.

Contreas said that the Commonwealth's sustainable development principles require that development take place where capacity is available, so any new development should take place in the context of these principles. Giles asked if it would be helpful if she furnished the ACOs for the next meeting. Clayton suggested that it may have been included with this month's information because, he noted, the Staff Recommendation had some reference to the ACOs and that information was very helpful. He wants to be sure there is a clear linkage between the ACOs and the action proposed by the Staff Recommendation.

Honkonen said that a public hearing on the Staff Recommendation was scheduled for next Thursday. The Staff Recommendation will then be brought to the February meeting for final approval. Rich asked if the system was constructed in 1894, were there plans to replace this system anyway, due to its age. Kovacs answered that MWRA monitors the pipes regularly, and infrastructure repairs are done as necessary. He said that there was a section of the Cummingsville pipe that was partially collapsed last year and the MWRA did emergency repairs. However, the Authority and its rate payers cannot afford to replace all of the 150+ year old pipes in the system. These pipes continue to be monitored. Rich asked if any of the public water suppliers affected by this project were present. He said that it appears that overflows occur within 300 feet of the 400 ft radius of the public water supply. It is just a matter of time before these wells become contaminated by these overflows. This is certainly a public health issue.

Kovacs replied that this was one of the reasons that this project had the full support of all the affected communities.

Honkonen encouraged Commission members and other interested parties to attend Thursday's public hearing.

**Agenda Item #4: Presentation – Northeast Rivers Forecast Center, National Weather Service, Taunton, MA**

Honkonen introduced Rishell, who is the Hydrologist-in-Charge of the National Weather Service in Taunton. Rishell stated that the parent agency of the National Weather Service was the National Oceanic and Atmospheric Agency (NOAA). The Northeast River Forecast Center is one of 13 such centers within the National Weather Service that serve the United States. The mission of the Northeast River Forecast Center (NERFC) is two-fold. Primarily, the center provides hydrologic information in the form of forecasts, warnings and technical information to protect lives and property. The secondary mission is to provide information to support the nation's economy and environmental well-being. This last area is where the Center ties into the WRC's work. The drought program is another. The Center is trying to get into other aspects of providing information for water management. Rishell said that the Center was open to suggestions on how to "package" this information so it could be better utilized by state agencies.

The NERFC is co-located with the Weather Service in Taunton, but covers a much larger area: all of New England and a portion of New York. Some of the inputs used by the NERFC are precipitation, temperature, and snow conditions. This information is obtained from the Weather Service, as well as other partners, including the Army Corps of Engineers, other federal agencies, state agencies, etc. Stream levels are obtained primarily from the USGS. Without their information, NERFC can't function. The Weather Service does not fund USGS on a direct basis, but there is a partnership on the national level where their budget initiatives to Congress are supported.

River modeling is done with both hydrologic and hydraulic approaches. Currently NERFC is using a deterministic forecast via a lumped model, but is getting into issuing probabilistic forecasts. Right now this is from a long-term standpoint (30 days out). NERFC is trying to get to the point where probabilistic forecasts can be issued from one hour out to 180 days.

The NERFC forecasting system is nationally supported but for every local forecast point, NERFC does the calibrations, maintains the model and makes any changes. There is a national model under development. There are limitations to the lumped model for forecasting purposes, especially with forecasting for smaller basins. The lumped model cannot take advantage of the radar station estimates that are now providing quality data. A more accurate national model should be operational in the next two years.

Currently NERFC is providing river stage forecasts for 20 locations. These are based on USGS station locations. The NERFC web page shows a current condition map. Information for the eastern 2/3 of Massachusetts comes from the Boston Weather Service office. The western part of the state gets its information from the Albany Weather Service office.

The NERFC model is in six hour time steps, which limits predictions for any basins smaller than 200 square miles. The response times of these basins are such that the six hour model cannot quantify the hydrograph fluctuations. Currently the Center is generally looking at basins of 200 square miles and larger. Twenty years of historical record for stage, precipitation and temperature are needed to calibrate the model. Access to real time stage and precipitation data is also required. If there are locations where a state agency or Commission needs forecasting information, the NERFC would be willing to use that location to develop forecasts, if the necessary data is available.

Marler asked about the difference between a distributed model and a lumped model. Rishell answered that the lumped model uses point precipitation and distributes this, using the mean areal approach, over the entire basin with a mathematical model. The distributed model accounts for precipitation at every grid point and it is then rounded to any point within the basin. One of the difficulties is that the current model used has to convert all these parameters.

Rishell offered to give the audience a tour of his facility.

Clayton asked about the level of accuracy using the existing modeling. Rishell said it is difficult to put a level of accuracy on their forecasting. He went over all the possible errors that could go into the forecasts, however there is some verification data that indicates that the mean average error is within a  $1/10^{\text{th}}$  of a foot for base flow conditions and within half a foot for high flow conditions, generally. NERFC is working on separating out these errors in order to focus on where the problems are. Clayton said that he would expect that early spring forecasting would be a problem due to snow pack melting. Rishell agreed. Unfortunately, he added, there have not been accurate ways to get all the information to predict snow melt, but the Weather Service is now collecting the type of data needed, and NERFC is trying to modify its models to incorporate this data.

There are some planned additional forecasting points that will be added to the forecasting model in the next couple of years. Four of these points are located within tributaries to the Connecticut River basin; three are located on the Charles Rivers and there are three others in located eastern Massachusetts. Currently, an antecedent precipitation index model is in use to determine soil moisture. In order to do more accurate forecasting, a continuous model should be used. NERFC will be using the Sacramento County soil moisture model and is in the process of recalibrating all of their existing data bases.

NERFC provides precipitation and soil information and issues a number of daily products, including outlooks for floods and drought. Clayton asked if they report in metric or English. Rishell replied that reporting is primarily in English. NERFC's mission is to be an information supplier and the information should be in a format that is easily understood and in the form desired. If someone asks for metric information, it can be converted.

Rishell said that a daily precipitation forecast is made for input into the hydrologic model, as well as a snow water equivalent map. These latter are updated every two weeks. Most snow surveys are done on a two-week cycle, but a few places are cutting back to once a month because of budgetary restrictions. This type of data is presented on the website.



Current conditions are the latest observations based on what is expected in the next 48 hours. NERFC's forecasts are issued in a 54 hour timeframe. The actual forecasts for individual locations are done in six-hour timesteps. Many of these applications "connect the dots" to create a hydrograph. Hydrographs on the website are updated once per hour. Garabedian asked who sets the flood stage. Rishell said that the Weather Service, in coordination with other federal agencies, local agencies and state emergency management agencies, sets the flood stage. NERFC's definition of flood stage is the level where damage begins to residential or commercial property or a secondary roadway becomes impassable. Garabedian asked that it was not necessarily just "overbank". Rishell agreed. The Weather Service flood stage, he said, is generally above bankful level. Clayton suggested that it might resonate more with the general public if NERFC called these "flood damage stages". Rishell said that there is a definition for minor, moderate and major flood levels. Minor flooding is the level where residential or commercial property is damaged or a secondary roadway becomes impassable; moderate flooding means that some evacuations are necessary; and major flooding means widespread evacuations are necessary.

Probabilistic forecasts are being generated. There has been a lot of feedback saying that these forecasts don't mean much to most people. If there are any ideas on how to display this information so that it would be more usable to most people, NERFC is open to these.

#### **Agenda Item #5: Presentation – Proposed Regulations for Biotechnology**

Reinhardt distributed the most recent draft proposed regulations. This topic came out of a larger state effort to try to make regulatory improvements to attract the biotech industry to Massachusetts. He referred to a Mass Biotech Council report that was published in April 2004. This effort involved looking at unnecessary requirements to try to make sense of the regulatory environment and try to streamline the process to make it more effective. He referred to handouts he had distributed which contained a list of all the environmental regulations that apply to the industry. These include five operational permits and three regulatory requirements that DEP is trying to revise through this process. DEP has worked with the biotech industry to come up with these proposals and also has consulted with EPA's waste division about pretreatment. We want to convert the sewer discharge permit for industrial wastewater and certified operator requirements, as well as the timetable requirements into a "permit by rule". This means that if an operator meets certain standards, they are essentially self-regulated. Reporting will be required.

The biotech industry overall is doing well with environmental issues, but the State wants to make sure that everything is being done to keep them in Massachusetts and flourish here. Tisa asked if this is because Massachusetts has lost other segments of its economy and does not want this to happen with biotech? Clayton replied that the Council report suggests is that there are an array of factors, including the regulatory climate, that could discourage the biotech industry.

DEP is aiming to have a public hearing-ready draft to be sent to EOEA for review by February and hopes to go to public hearings in March and to promulgate the regulations by June. Reinhardt said that the draft regulation distributed today were not for general public distribution. EOEA needs to approve them before they are ready for wider distribution.

The biotech definition in the regulations is very broad to capture as many types of uses as possible. The regulations cover biotech industries that discharge to sewers, where the sewer system has an industrial pretreatment program. These regulations do not cover facilities with ground water discharge permits or smaller sewer systems without pretreatment programs. These regulations are analogous to a federal “categorical” standard, which sets minimal standards that should be in place. If the biotech industry is on the MWRA system, these regulations will not apply because the MWRA is a “delegated” system.

The regulations provide for a presumptive approval. Meet the standards and a permit is not required. All of the discharge parameters for the 47 treatment plants with industrial pretreatment programs that have limits were assessed. Then, pollutants of concern, based on USEPA’s analyses, were evaluated. These are significant pollutants that probably will be regulated. Hazardous waste limits were also considered. If there are local limits that are more stringent than the ones that are indicated in the proposed regulations, the biotech facility would have to comply with the more stringent regulations. The regulations have provisions that prescribe the operator grade for various biotech facilities, rather than have each facility go through an individual grading process required in 257 CMR 257.00. In order to qualify to be regulated under these proposed regulations, a facility must have an operation and maintenance plan. There are record keeping and monitoring requirements. Gildesgame asked if the state will conduct spot inspections to assess compliance. Yes, Reinhardt replied, but this is accounted for in DEP’s enforcement policies and actions, which are separate. Clayton asked if living organisms that might be in these waste streams are addressed. Reinhardt answered that this is addressed in the public health regulations and the plumbing code. There is a recommendation to get these in sync. The Department of Public Health standards preclude anything living getting into the waste stream. Pelczarski asked if the discharge of pharmaceuticals is regulated. No, replied Reinhardt, this is something DEP is looking at but has not started regulating. Clayton stated that the broad definition for biotech industries could include breweries and bakeries. Are we being too inclusive? Giles said it is probably not in the interest for breweries or bakeries to apply for presumptive approval under these regulations because they would have to monitor for all types of chemicals that are not involved in their processes. Hogan noted that the regulations apply only to facilities with prescribed Federal Food Administration research applications, which would not include bakeries and breweries.

Yeo asked that it be made very clear that these proposed regulations do not apply to industries which discharge to the MWRA system. Reinhardt said that this was stated in the regulations, but yes, DEP could emphasize this. Clayton asked if MWRA was being asked to consider a similar “permit by rule”. Yeo replied no. Zimmerman asked how MWRA arrived at the numbers it used for these discharge parameters. Yeo replied that MWRA used a multiyear local limits process. All discharges and environmental issues are reviewed and worked back upstream to assess where there might be problems. Local limits are then set appropriately. This happens every five years. Clayton asked if DEP would come back to the WRC, once they have regulations ready to be promulgated. Reinhardt said that this would happen after the public hearings.

**Agenda Item #6: Presentation – Relative Sea Level Rise in Massachusetts**

Pelczarski stated that one of CZM's responsibilities is to keep track of climate change. The NOAA website lists the annual temperature of Massachusetts. From 1890 to 2000, temperature has gone up slightly. It was asked if this change was statistically significant. Pelczarski answered that there were a lot a variables involved, so it is difficult to tell. This time frame, 1890 to 2000, is not very long in terms of climate.

Average annual precipitation has increased from about 37 in to about 49 inches (during this time frame?). Pelczarski said that back in the day, when he was in high school and college, the major concern in his science classes was global cooling. The theory was that the climate was going to revert back to the Ice Age. Now, all the talk is of global warming. Giles said that there are records that support the global warming hypothesis. Pelczarski replied that there were also records that supported the global cooling hypothesis. The record he is presenting here only applies to Massachusetts, over this relatively short period of time. Dry times follow wet times and vice versa.

There are sea level tide gages in Massachusetts, in Boston, Woods Hole, Nantucket, and New Bedford. The record is very short, but these levels appear to be rising slowly. He referred to points on the graph that related to storms, but said that in 1997, on a very calm day, sea level rose to 1978 storm levels. This was due to a gravity wave.

The best gages in Massachusetts are in Boston and Nantucket. Gages are kept world-wide. The longest series of tide records are from the Mediterranean Sea. The Mediterranean experiences a lot of extreme events such as tsunamis, earthquakes and volcanoes. Gages are being linked to satellites. NOAA has been measuring temperatures in the ocean using sound. The sound in the ocean is dependant on the temperature. Within long distances, short changes in timeframes means temperature is either rising or falling.

Satellites using radar show that globally, in the context of a short time frame, sea level is rising. The satellites are getting more sophisticated.

In the past, over the course of geologic time, we've been warmer and colder and sea level has been higher and lower. Trowbridge looked at sea level in an article published in Scientific America in 1960. He started with the assumption that the globe can go from all water to all ice. In the past, sea level is about 100 meters higher and 100 meters lower than today. In the geologic past, glaciers wiped out all traces of where the high end of sea level was in Massachusetts.

Archeological evidence indicates that humans have been in North America for at least 17,000 years. In addition, some pit charcoal has been discovered that indicates that humans may have been in North America 35,00 years ago. In last 6,000 years there was a fast acceleration in sea level rise. Pelczarski showed an illustration of what the shoreline looked like 17,000 years ago.

A recent study of glaciers in Peru revealed plants under the glaciers that were generally only 2000 years old, however this study also discovered plants that were in the 30-35,000 year range.

Things that can change sea level:

- Basin shape changes. For example, the recent tsunami caused dramatic changes to that basin. Basin shape changes are also caused by plate tectonics, land slides, natural gas deposits in crystal form found off the Atlantic shelf, undersea volcanoes, island formation, lava flows, etc.
- Changes in the Earth's rotation. There are all kinds of oscillations as well as normal fluctuations in the earth's orbit around the sun. The relationship of the earth's orbit to glaciations has been determined mathematically.
- Changes in the sun's output. This is just beginning to be monitored through satellite technology.
- Unknowns: Gravity waves - this is when cold air from the upper atmosphere suddenly falls into the lower realm of the atmosphere where life occurs. This generally happens around mountain areas. However, it did happen south of Providence in the Atlantic Ocean. A large amount of cold air suddenly came down into the lower atmosphere. Tide gages in Providence recorded high tide twice the normal amount. Water levels at the Charles River Dam were equal to those of 1978 because of this anomaly. Parking lots in Salem and all the way up the Gulf of Maine were flooded. There were no storms in the area. Odd tides were recorded by the Weather Services in both the US and Canada, which did not know what was going on at the time. There is a paper on the National Weather Service web site describing gravity waves, which are believed to be the cause of this anomaly.
- Manmade changes – barriers to tidal basins.

Tidal range changes can alter terrestrial habitats, depending on the type of shoreline. Salt marshes will change. Manmade structures such as docks and pier will be impacted. With a tidal range change, some research says surging will not be as problematic because more energy will need to go into raising tide surges. Beach erosion will be a problem. Well water could be impacted by salt water intrusion.

Effects of sea level rise are similar to tidal range change, but sea level rise changes are slightly different. Depending on how many feet sea level rises, so many feet of inland areas will be affected. There could be higher storm surges and higher water tables, which could affect land drainage capacity. Wetlands will lose their ability to migrate.

In the 1980's it was determined in Massachusetts that, if there is 100<sup>th</sup> of a foot of sea level rise per year, there will be 65 acres of upland lost each year. Towns that are losing the most acres to sea level rise per year: Nantucket, Wareham, and Boston. Paul Kirshan of Tufts University looked at sea level rise in the MAPC area using several variables. They looked at the economic costs of mitigating and of adapting to sea level rise.

Changes could occur to the Gulf Stream. This could cause the breakdown of the social order. Global warming will flip to global cooling very quickly if there are changes to the Gulf Stream. The North Atlantic oscillation could be impacted, which will impact ocean life and the frequency and severity of storms. If this happens biodiversity will be lost and the variability of precipitation will change. There will be a lot more rain and a lot more droughts.

In Boston, there is such a heavily built infrastructure, that it would be worth it to fight sea level rise. Massachusetts has an action plan, which includes the reduction of CO<sub>2</sub> gases. There have been some interesting experiments with iron. Iron has been placed over large areas of the ocean and this has attracted plankton that utilizes carbon from the atmosphere. There is a Federal grant program for removing carbon from the air.

Earth's climate and sea level have always changed. Current research says that human activities are causing at least part of it. How much is unknown. Atmospheric chemistry is very, very complicated, as is ocean circulation. Ice cores show that changes can happen in a decade.

Giles requested a copy of Pelczarski's presentation.

Meeting adjourned